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Request for a copy of your report on the Hubbali-Ankola railway line

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The executive summary is appended for your info:

EXECUTIVE SUMMARY

HUBLI-ANKOLA BROADGAUGE RAILWAY LINE

The west coast rail links passing through the biodiversity rich Western Ghats to the hinterlands are very rare unlike the linkages through the road networks. The Mumbai-Pune rail, through Lonavala hills was the earliest one established in 1856. The Vasco-Londa rail routes, through Castle Rock in Uttara Kannada and the Quilon-Tenkasi rail through the narrow Aryankavu Pass in southern Western Ghats are over a century old and rare of its kind. Late in the 20th century was established the Mangalore-Hassan rail route cutting across many an evergreen forests of the Western Ghats. Most trains from Kerala have their vital connectivity towards Tamil Nadu and beyond through the Palghat Gap hardly affecting the Western Ghats as such, except for its fringe forests, notable for elephant movements, in Walayar towards the north-east of the Palghat Gap. The Konkan Railway that became operational 1998 is more of a coastal route touching the western fringes of Western Ghats in parts of Uttara Kannada, Goa and Maharashtra. Thus it could be stated that, though railways constitute the most effective means for bulk transport of goods and passengers on land, with considerable energy efficiency than the road transport, they had hitherto least impact on the Western Ghats unlike the scores of roads and associated linear growth of human settlements, farmlands and industries which created much more fragmentation in the natural ecosystems than railways did.

Yet, in spite of the relative advantages of the railways over the road transport, the starting of a new rail route through the Western Ghats raises many issues related to environment impacts, of which there is much more awareness and concern today than in the past. Establishment of any new rail project, for that matter, being a major enterprise deserves critical examination from the environmental angle. among the Western Ghats and the Operational constraints of loaded trains in the ghats sections of Londa-Vasco and Sakleshpur-Mangalore routes with sharp curves and steep gradients have seriously hampered bulk cargo movements. Reduced speed and multiple locomotives for hauling/braking power of loaded trains have impaired the capacity of the existing lines. It is in this context that the Ministry of Railways, Government of India proposed a new broad gauge railway line from Hubli to Ankola between 14°42’ to 15°20’ North latitude and 74°17’ to 75°7’ East longitude in Karnataka. The total

length of Hubli-Ankola broad gauge line project from Hubli junction to the Y-junction arrangement near Ankola connecting the Konkan Railway Corporation Line (KRCL) is 168.289 km. The line ends at the Y-junction at 164.931 km and two main lines in the Y-junction arrangement connect KRCL line towards Karwar and Ankola ends with a length of 1.722 km and 1.636 km respectively.

A formation width of 6.85 m with 2:1 side slopes is proposed (as per No 86/w5/Misc/D/26, 01 Feb 1991) for embankments whereas a formation width of 9.25 m with 1:1 side slopes is proposed for cutting. Provision has been made for 2 m-3 m wide berms for high embankments / deep cuttings. The total length of the track in embankment is 79 kms and the maximum height of bank is about 25 m. The total length of the track in cutting is about 68.73 kms and the maximum depth of cutting is 25 m. the total length of track passing through tunnels is 21.875 kms and the longest tunnel is 3525 m long. 29 tunnels spanning over 22,325 m mostly in the undulating forested regions have been proposed to minimise the damage of forest vegetation while maintaining the required gradient. Totally there are 329 bridges to be built in this project of which 50 are major and 279 are minor bridges. There are total 8 level crossings in this project, 2 of which already exist on the Hubli-Bangalore line near Hubli. There are 20 RUBs (Road under bridge) and 28 ROBs (Road over bridge) in this section. A total of 12 stations namely Hubli, Mishrikoti, Kalghatgi, Kirvatti, Yellapur, Kanchimane, Ramanguli, Sunksal, Jonalli, Navagadde, Y-Junction and Ankola are proposed, taking into account the requirement of a station at every 12 km as per Railway Authority, India. 565 staff quarters as per the requirements of the user departments such as civil, S&T, operating, commercial, electrical, mechanical, etc. at all stations have been provided.

The total land required for the implementation of the project is 1142.0 hectares. Land for widening the roads and for new roads amounts to an additional 15 hectares. Different land uses in this region are forests (727 hectares, 63.66%), followed by crop land (210 hectares, 18.39%), wetlands – tanks and ponds, streams (179.60 hectares, 15,73%), Garden or horticulture land (24 hectares, 2.10%) and human habitations (1.40 hectares, 0.12%). 29 tunnels spanning over 22,325 m mostly in the undulating forested regions have been proposed to minimise the damage of forest vegetation and for the gradient management in the Western Ghats. It is estimated that about 295.46 hectares is required for 10 m from the toe of the bank/cutting on either side. Estimated land requirement to dump the debris considering the height of heap as 15 m is about 207 .06 hectares.

The salient features of the proposed railway line connecting Hubli to Ankola are

- The new broad gauge Hubli-Ankola line will connect the densely populated west coast of the nation to the hinterland.
- The alignment passes through the Western Ghats covered with forest
- The line is falling from a level of 637 m to 18.7 m above MSL
- The proposed line will be of use specially for its connection to Belekeri, Tadri and Karwar ports (cater to the traffic of about 27 MT cargo)
- This line will be linkage between west coast ports and naval harbours with the industrially and agriculturally developed vast hinterlands of Karnataka and Maharashtra

- Vital link for connecting west coast with the east coast.
- Movement of materials, equipment, work force of various projects (Project Sea bird, Kaiga nuclear power, etc.)
- Better alternative for mail, and express trains from north, north-east and central India to southern states.
- Link to Vasco and Mangalore ports through Konkan railways
- Imported coal/coke through Murmagoa or Mangalore port to steel industries, coal based thermal power station at Bellary and Hospet region (steel industries - Mukund iron, Kirloskar, JVSL, Bellary steels, etc.).
- Ideal for transport of timber imported through especially Mangalore port and for oil and gas from MRPL, Mangalore, which otherwise require plying of hundreds of heavy trucks every day, which constrain the coastal and Western Ghat roads that are already subject to heavy pounding of the monsoon rains.
- This line will be the most viable alternative route to move extra iron ore traffic from Bellary-Hospet sector to the Murmagoa port in Goa.
- Might help in the development of the backward regions of North Karnataka.
- This project will provide better employment opportunities, quick service, safety and less consumption of the fuel with lesser air pollution

The Infrastructure Development Department (IDD), Government of Karnataka has engaged Indian Institute of Science (IISc) to undertake the investigations related to biodiversity, environment impact assessment and mitigation measures vide letter IDD 25 NSW 2008 dated 19/02/2011.

TERMS OF REFERENCE (TOR) OF THE STUDY:

TOR as per IDD communication is:

i. Documentation of the existing flora in the proposed corridor
ii. Documentation of animal paths
iii. Documentation of medicinal and endemic species
iv. Assessing the Environmental Impacts
v. Documentation of flow patterns of rivers and rivulets
vi. Geo hydrological and Geo technical studies
vii. Engineering solutions appropriate for laying the track

viii. Arriving at environmental management plan to achieve the least disturbance to the existing flora and fauna

The report consists of two parts - Part A of the report discusses i-iv and viii and Part B covers v-vii with some relevant aspects of viii.

METHOD

Integrated approach using conventional methods in data collection and latest technologies such as GIS and remote sensing were used in assessing the ecological status of the region and likely impacts due to the proposed project. This involved field data collection, ground truth verification, historical and socio-economic aspects, land use analyses using GIS and remote sensing, water and soil characterization, vegetation studies, fauna distribution, fisheries, etc.

Pre- project Scenario of Vegetation, Land-use and Fauna: Data was gathered on flora, fauna and ecology of the region, as well as from forestry sources, folk knowledge, and relic vegetation and fauna.

a) **Documentation of the existing flora along the corridor:** Point-centred quarter method for tree vegetation and quadrats for shrubs were used, in addition to opportunistic surveys, all along the proposed alignment and its buffer zone.

b) **Documentation of medicinal and endemic species:** Medicinal plants growing naturally, associated with various landscape elements, were catalogued and their traditional and emerging uses portrayed briefly. Indian pharmacopeias, ethno-botanical literature and medicinal plant lists and studies prepared by FRLHT, Bangalore, were used for references.

- The proposed corridor was overlaid on remote sensing imagery and landscape elements such as evergreen, semi-evergreen and deciduous forests, scrub, savanna, forest plantations, grasslands etc. identified in the imagery and through ground surveys and **sector-wise maps depicting the landscape elements** were prepared.
- Ground surveys were carried out in every grid for **verification of the landscape elements.**
- **Land cover and land use parameters**, enabling in understand of natural resources, hydrological cycles, and associated biodiversity, were analyzed. Maps depicting land-use-land-cover have been generated using remote sensing imageries and ground surveys.
- Plant communities along the alignment were correlated to topography, geology, soil and water.
- Herbarium was prepared of rare plants (including pteridophytes). Unidentified species were identified using standard floras.
- Tree density and diversity along the corridor were surveyed using **Point-Centred Quarter method.** Ground vegetation diversity and status were assessed using 25 sq. m **quadrats** for tree saplings and shrubs and the herbs that occurred were noted down (could not complete herbs due to summer season as the seasonal herbs had vanished)

- The adequacy of samples was assessed for any notable forest patch using **species area curves**, so that the occurrences of floristic elements are fairly well represented.
- **All out survey** were made along the corridor for rare species that do not by chance fall within the samples
- Forest patches in every grid were assessed for 'evergreenness' and floral endemism, of forest-dwelling trees, shrubs, herbs and climbers.
- Grid-wise occurrence of **threatened plant species** were made using the latest IUCN Red List
- Sector-wise calculation of **above-ground tree biomass** was made based on field measurements of trees in sample plots and the detailed enumeration of trees en-route already carried out in detail by the Karwar, Yellapur and Dharwar forest divisions
- The occurrence of **medicinal plants** will be mapped along the corridor. **Phytoplankton** w**as** sampled in the water bodies en route using nets of appropriate mesh size

c) Survey of faunal diversity and animal paths

- All major elements of **faunal diversity** (especially of butterflies, fishes, amphibians, reptiles, birds and mammals) were documented using the services of wild life scientists, and using suitable methodology for each group.
- Butterflies were identified through larval and adult identification. The presence of **larval host plants** were used as keys for estimating the likely occurrence of many butterflies that may be unseen during the time of survey.
- **Animal corridors and movement paths**, including of elephants, as available from existing literature, forest department data, wild life experts, and local inhabitants were depicted on GIS based maps.
- Proposals for mitigation of impact on wildlife due to the passage of the railway through their habitats/ movement paths were made in consultation with wildlife experts and referring to various studies already carried out.
- **Fish fauna** in the water bodies along the path were sampled using standard fish sampling techniques, with the help of local fishermen. Endemism of fishes in the streams/river along the corridor was estiamted using the available literature on Western Ghat fishes. Threat status of fishes, if any, were brought out using IUCN Red List.
- **Amphibian documentation** was carried out through mainly through night sampling. Special efforts were made to identify amphibian micro-habitats. Secondary data was also also used as the rainy season was almost past causing the withdrawal of most species into their hideouts.
- IUCN Red Lists were used for finding out the threat status of various faunal elements

  List of plants that contribute to the **food resources of wildlife** was made using various studies and information collected from local people and forest department officials. While proposing appropriate mitigation methods for wildlife that are likely to be affected, care has been taken to recommend use of various fodder plant species that can be planted in suitable areas in every sector.

d) Hydrology, Lithology

- The perenniality of the water courses along the, or crossing the corridor, were ascertained using available hydrological data pertaining to the region as well as through enquiries with the local inhabitants. Site-specific mitigation of the impacts due to railway alignment were prepared
- Rocks and soils along the alignment were examined for assessing terrain stability and, if

necessary, for proposing minor deviations in the alignment.

- The proposed rail alignment was examined against the **drainage network** and intensity of streams.
- As the alignment is passing through also some of the fragile terrain susceptible to landslides, such **landslide-prone terrain will be identified and depicted on the maps** based on the rocks and soil and hill slope.

e) Assessing the environmental Impacts

We would focus on problems, conflicts or natural resource constraints that could affect the viability of a project. It also examines implications of a project that might harm people, their homeland or their livelihoods, or other nearby developments. After predicting the problems, measures to minimise the problems and outlines ways to improve the project's suitability for its proposed environment have been assessed.

f) Development of Environment Management Plan (EMP):

The mitigation and management programs would address the mitigatory measures to restore and preserve the eco-systems from the possible adverse impacts due to the proposed Hubli-Ankola railway project. The mitigation measures are suggested to minimize or prevent negative impacts on environment due to proposed development activity. The main impacts on the environment are likely to occur during construction phase with some important impacts occurring during operational phase. In the EMP, provides all possible corrective measures to ensure that these adverse effects are kept to minimum.

The mitigation and management methods would reflect, not only the studies and consultations during the short period of this specific study, but the entire cumulative gains and experience of working in this region for over a two and half decades.

CONSTITUTION OF THE TEAM

The study was undertaken by a multidisciplinary team of scientists and engineers that comprised of ecologists, environmental engineers, GIS and remote sensing experts, lichenologists, phycologists, botanists, zoologists, soil and water scientists, geologists, entomologists and wildlife experts. Aspects/Facets of the study are:

- Analysis of alternate routes;
- Landscape: Land use Land Cover (LULC) Dynamics, fragmentation of forests;
- Biodiversity: Terrestrial and aquatic;
- Faunal diversity;
- Animal movement paths;
- Carbon sequestration potential of forests;
- Soil, water characterization;
- Energy;

- Socio-economic aspects, etc.;
- Valuation of ecosystems;
- Environmental Impacts Assessment.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA): OVERVIEW

Environmental Impact Assessment (EIA) means an examination, analysis and assessment of planned activities with a view to ensure environmentally sound and sustainable development. The essential of the environmental impact assessment is to achieve sustained development with minimal environmental degradation and prevention of long-term adverse effect by incorporating suitable prevention and control measures. Essentially, EIA is a tool for decision-makers to identify and predict the impact of legislative proposals, policies, programmes, projects, and operational procedures on environment and man's health and wellbeing and interpret and communicate information about the impact. Major stages in EIA are

i. **Establishing the environmental baseline:** This includes both the present and likely future state of the environment, assuming that the project is not undertaken, taking into account changes resulting from natural events and from other human activities.
ii. **Impact identification**: Impact identification brings together project characteristics and baseline environmental characteristics with the aim of ensuring that all potentially significant environmental impacts (adverse or favourable) are identified and taken into account in the EIA process.
iii. **Impact prediction, evaluation and mitigation:** EIA is all about prediction and is needed at the earliest stages when the project, including alternatives, is being planned and designed, and this continues through to mitigation, monitoring and auditing. Evaluation follows from prediction and involves an assessment of the relative significance of the impacts. The methods of evaluation range from intuitive to the analytical, from qualitative to quantitative, and from formal to informal. Cost benefit analysis, monetary valuation techniques, and multi-criteria/multi-attribute methods, with their scoring and weighting systems, provide a number of ways for the evaluation issues. Mitigation of significant adverse effects involves the measures to avoid, reduce, remedy or compensate for the various impacts associated with projects. The possible mitigation measures include:
    1. Changing project sites, routes, processes, raw materials, operating methods, disposal routes or locations, timing, or engineering designs.
    2. Introducing pollution controls, waste treatment, monitoring, phased implementation, landscaping, personnel training, special social services or public education.

3. Offering (as compensation) restoration of damaged resources, money to affected persons, concessions on other issues, or off-site programmes to enhance some other aspect of the environment or quality of life for the community.

iv. **Environment impact statement (EIS):** EIS provides documentation of the information and estimates of the impacts derived from various steps in the process. An EIS revealing many significant unavoidable adverse impacts would provide valuable information that could contribute to the abandonment or substantial modification of a proposed development action. Where adverse impacts can be successfully reduced through mitigation measures, there may be a different decision.

v. **Participation, requisites and review:** The aim of the EIA process is to provide information about a proposal's likely environmental impacts to the developer, public and decision-makers so that an informed decision is made. As such, how the information is presented, how the various interested parties use that information, and how the final decision incorporates the results of the EIA and the views of the various parties, are essential components in the EIA process.

THE STUDY AREA – DESCRIPTION

The study area covers the proposed alignment of the Hubli to Ankola railway line and the 5 km buffer region on both sides. . The railway line covers 168.3 km, between long $74^0$18' 34.54" to $75^0$10' E and lat 14^0 41'33.80" to 15^0 20'45.30" N and having elevation range of 23 m (Ankola) to 637 m (Hubli). It connects Dharwad and Uttara Kannda districts of Karnataka state, India. This has been done considering the buffer region which is likely to be affected in long term. The proposed railway line passes through dry land, wetlands, forest land, agriculture land, and built up land etc.

The forest land forms a major part (63.4%) of the total land to be acquired for the project followed by crop land / dry land (18.5%), wet land (15.8%), garden land (2.1%) and built-up area (0.2%). The forest area to be acquired for this project falls within three different forest divisions namely Dharwad forest division (in Dharwad district) and Yellapur and Karwar forest divisions (in Uttara Kannada district). The forest land through which the alignment passes involves forests in plain section and Ghat sections. The Ghat section is from Yellapur to Sunksal covering a length of 63.11 kms. The section between Sunksal and Y-junction (in Ankola) is plain with dotted mountains.

The proposed alignment passes through the Western Ghats forests and the region is part of Bedthi conservation reserve (at Yellapur), closer to Dandeli Hornbill Conservation reserve and a part of it is located in the buffer region of Anshi Dandeli Tiger Reserve (about 6.5 km from Anshi Dandeli Tiger reserve at the closest point). The protected areas in the form of National Parks, Wildlife Sanctuaries,

Conservation Reserves, etc. serve as an important repository of rich biodiversity and are assigned highest conservation values so as to not disturb them.

The total forest land area to be acquired for this project is 727 ha of which the major proportion is formed by Yellapur taluk with 357.07 ha of land (49.12%) and Ankola taluk with 326.54 ha (44.92%). The forest land to be acquired in Hubli region forms a minor portion of 43.38 ha (5.96%). In the railway zone, between Hubli to Kalghatgi, the terrain is flatter with gentle undulations and the landscapes are dominated by grasslands and scrubs, bamboo areas intermixed with sparse tree vegetation and monocultures of mainly teak, eucalypts and acacia. The forests in better form begin to appear from Kalghatgi towards Kirwatti. The Kirwatti to Yellapur zone is characterized mainly by moist deciduous forests as the rainfall exceeds 1200 mm and steadily increases towards Yellapur to over 1800 mm favouring occurrence of semi-evergreen forests. Yellapur to Sunksal is a very rugged terrain of steep rising hills and valleys with altitude ranging from 150 to 450 amsl, dense forests and heavy rainfall (1800 – 2500 mm). The natural forests here are of evergreen to semi-evergreen types characterized by several endemic tree species such as *Myristica malabarica, Polyalthia fragrans, Cinnamomum macrocarpum, Holigarna grahami, H. arnottiana, Hopea ponga* etc. Sunksal to Ankola, a width of about 30 km belong to the foothills zone of the Western Ghats, which is very hilly (18 to 150 amsl) and dominated by secondary moist deciduous to semi-evergreen forests.

BASELINE INFORMATION

Land Use Land Cover (LULC) Dynamics: Land use and Land cover (LULC) analysis through temporal remote sensing data help in understanding the landscape dynamics and the drivers responsible for changes. The land cover analysis carried out for the railway alignment of 168 km with a buffer of 5 kms on either side of the track, show that area under vegetation was about 98.78% (1973) has reduced to 83.14% (2010) due to anthropogenic factors. Land use analysis reveal that area under human habitations has increased from 0.18% (1973) to 0.81% (2010), the area of deciduous forest is decreased from 56.23% (1973) to 47.93% (2010), whereas agricultural land has increased from 25.55% to 30.31%. Predictions based on these temporal changes reveal that there would be about 11.8 % decline in forest vegetation cover in the region by 2020. The simulation consequent to land use changes with implementation of railway project, indicates a decline of 16.23 percent forests in the region.

This essentially helped to understand the change dynamics, which aided in the projecting the growth

pattern for 2020. The base layers are used to forecast the growth process for the year 2020 with and without the Railway line. This indicates that if the present change trend continues there would be decline in the forest cover by 11.8 percent in the Year 2020. Similarly, the simulation indicated that there would be a decline by 16.23 percent in the region consequent to spurt in land use changes with the implementation of Railway.

The spatial metrics (for the years 1973, 1989, and 2010) with respect to each sector is computed to understand the landscape status in terms of heterogeneity and diversity. The metrics were prioritized based on the literature review suitable for the study region. The results show the higher value of diversity due to higher fragmentation in the distribution of patches.

Documentation of Biodiversity: For scientific documentation of the vegetation along the proposed railway line, the linear stretch of about 169 kms, was divided into 13 sectors, each of 13 km length. The 13 km sectors were serially numbered 1 to 13 from Ankola towards Hubli. As only first 10 sectors had forest tree vegetation, our main forest studies were confined to these sectors. The other sectors between Kalghatgi and Hubli had mainly scrub and grasslands with isolated stunted trees and bamboos and some eucalyptus plantations.

The floristic study in the Hubli-Ankola railway zone reveals the presence of 43 families, 106 genera and 134 species of trees and 58 families, 128 genera and 146 species of shrubs along the proposed rail alignment. Out of the ten sectors studied on the proposed alignment, sector-6 and 7 comprised of evergreen to semi evergreen forest along a high rainfall rugged hilly terrain with lesser human disturbances. The Sector 6 with lofty evergreen to semi evergreen forests was found to be having the highest basal area/ha (84.15 m^2) and the highest tree number/ha (598) and showed the presence of magnificent trees belonging to *Lophopetalum wightianum, Persea macrantha, Ficus nervosa* etc with GBH more than 400 cm. The species diversity analysis in the Hubli-Ankola railway zone revealed that the sectors – 6, 7 and 8 had highest species diversity as they harboured evergreen to semi-evergreen forests and had less human disturbances compared to the other sectors. The highest percentage of tree endemism (45%) along with a high percentage of evergreens (87%) was found in Sector-6 covering Vajralli – Birgadde villages in Yellapur taluk along a rugged terrain of steep hills and narrow wet valleys.

Medicinal Plants: The current study also highlights the presence of many wild and cultivated species of medicinal plants used widely by the local population residing in and around the Hubli-Ankola

railway zone. Medicinal plants like Aloe (*Aloe vera*), Vasaca (*Adhatoda zeylanica*), Brahmi (*Centella asiatica*), Hippali (*Piper longum*), Kokum (*Garcinia indica*) etc. are typically associated with the home gardens of the region whereas Kodase (*Holarrhena antidysentrica*), Sarpagandha (*Rauwolfia serpentina*), Sarasapilla (*Hemidesmus indicus*), Ekanayaka (*Salacia chinensis*) etc. are associated with scrub jungles, savannahs and deciduous forests. Dalchini (*Cinnamomum* sp.), *Coscinium fenestritum*, an endangered climber, Wild pepper (*Piper nigrum*), Patali (*Stereospermum personatum*) and numerous others are found associated with evergreen – semi-evergreen forests of the Yellapur Ghats. The local population uses numerous species of wild and semi-wild plants as nutraceuticals, as both food and medicine. These include the seed fat and fruits of *Garcinia indica*, *Garcinia cambogea*, fruits of *Emblica officinalis*, leaves of Brahmi (*Centella asiatica*), curry leaves (*Murraya koenigii*), shoots of *Polygonum* sp. etc. The fragrant roots of Sugandhi (*Hemidesmus indicus*) are used in soft drinks and medicines. The bark and leaves of Cinnamon are widely used as spices and medicines.

Faunal diversity: The forests in Hubli-Ankola railway zone are also rich in wildlife with the presence of 29 species of mammals, 256 species of birds as per the checklist (70 species recorded during our survey) of birds, 8 species of reptiles and 50 different species of butterflies. Most of the mammals found in this zone figured in the IUCN Red List signifying their high conservation status and almost all of them were protected under the Schedules of Indian Wildlife Protection Act (IWPA), 1972. The presence of Tiger (Endangered and Schedule-I species), which is a very powerful symbol (keystone species) associated with different cultures around the world has been recorded in the Yellapur and Karwar forest divisions. The birds recorded from this region such as Hornbills figure in Schedule-I of the Indian Wildlife Protection Act whereas birds including Barbets, Babblers, Bulbuls, Egrets, Fairy Blue bird, etc. figure in Schedule-IV of the IWPA indicating their rarity and high conservation importance. The Bedthi river basin harbors 33 different species of amphibians of which 55% are endemics to the Western Ghats. *Philautus* cf. *leucorhinus*, a species possibly thought extinct has been recorded from this region.

Animal Movement Path: The Asian elephants have been described as **endangered by the Wildlife Protection Act, 1972** (Appendix-1) and by Appendix 1 of the Convention of International Trade of Endangered Species of Flora and Fauna (CITES) in 1975. They are also regarded as premier ‘Flagship species’ and sometimes also called ‘Keystone species’ because of their important role in ecology and environment. The movement of elephants from one forest area to another allows the exchange of genetic materials between populations and thereby, prevents inbreeding depression. The Kalghatgi forest range in Dharwad Forest Division has witnessed the movement of elephants in the region since last many years. The belt of Kalghatgi range, coming under Devikoppa, Tambur and Sangtikoppa sections, adjoining Kirwatti and Bhagwati is the traditional elephant corridor. The herd of elephants moves from Dandeli Wildlife Sanctuary and passes through Bhagwati, Kalghatgi, Kirwatti, Mundgod,

Katur before reaching Hanagal. The elephants usually move in Kalghatgi range during the months of September to December. The proposed line passes through the region which is an important movement path for the elephants during September to February months. The construction of railway track will fragment the existing movement path of the elephants and will also pose a threat of train-hits on elephants. The fragmentation of the movement path will result into the elephants wandering in the nearby areas (mostly agricultural and horticultural lands) leading to problems like crop destruction, damage to hoardings/houses, injuring people, etc. Thus, the incidences of human-animal conflict will increase because of the fragmentation of natural habitats and movement paths.

Landslide susceptible locations: The causal parameters that influence landslides are precipitation intensity, slope, soil type, elevation, vegetation, and temporal changes in land cover. The present study demonstrated the effectiveness of two pattern recognition techniques: Genetic Algorithm for Rule-set Prediction and Support Vector Machine. The landslide hazard prediction study conducted in Uttara Kannada has shown that these techniques with small datasets can yield landslide susceptibility maps of significant predictive power. The efficiency of the model has been demonstrated by the successful validation. However, when the predicted features may have different immediate causes, one should carefully avoid including triggering factors among the predictor variables since they restrict the scope of the prediction map and convey often a poorly constrained time dimensions. The reliability of the susceptibility map fundamentally depends on the quality of the data and sample size apart from appropriately validation. The analysis showed that SVM applied on precipitation data of the wettest month with 96% accuracy was close to reality for Uttara Kannada district. Vajralli and some pockets of Yellapur are susceptible to landslides/mudslides along the proposed railway line.

Carbon Sequestration Potential of Forests in the region: The analysis shows that in an area of 727 hectares, removal of trees leads to the loss of 225214.59 tons of carbon apart from sequestration potential of 1580 tons of carbon per year (conservative estimate, based on average values of above ground biomass increment) or 3696 t per year (considering higher increment values)

Ecosystem Goods and Services from forests of Hubli-Ankola railway zone: Forest ecosystem goods and services, and the natural capital stocks that produce them, make significant direct and indirect contributions to national economies and human welfare. The forests of Hubli-Ankola railway zone are very productive and provide a large number of tangible and intangible goods and services to the people residing in this region. The important forest produce collected from the forests of Yellapur include honey, wax, shigekai, uppage, herde, watehuli, etc. while the important forest produce collected from the forests of Ankola taluk include Honey, shigekai, uppage, amasole, canes, cashew

nuts, dalchini leaves, etc. The total economic value (TEV) including provisioning, regulating, supporting and information functions for the forests in Hubli-Ankola railway zone was found to be Rs. 2,970,435,934 per year with a productivity value of Rs. 4,085,882/ha/yr.

ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

The proposed project will induce both positive and negative impacts on the eco-system and life of the community in the railway zone. Some of the important impacts due to the proposed project are as follows:

Negative Impacts

- Changes in the land use/land cover of the region
- Displacement of people and cutting of large number of trees
- Impacts on wild animals and their movement paths
- Risks due to landslides, mudslides and earthquakes
- Smuggling of timber and forest goods
- Loss of habitats for wild animals and effects of blasting on fauna
- Loss of carbon sequestration ability due to large amount of vegetation removal
- Members of work force trespassing inside the forests and leading to human-animal conflicts
- Solid waste and liquid waste generation during the operation phase

Positive Impacts

- Fuel savings and reduction in green house gases as compared to road traffic
- Economical means of transportation to the local people
- Vital link for connecting the eastern and western coasts
- Significant role in the overall development of northern Karnataka
- Convenient movement of materials, equipments and work force for various projects like Project Seabird, Kaiga Nuclear Power Plant, etc.

The proposed Hubli-Ankola railway line passes through different types of forests including evergreen, semi-evergreen, moist deciduous and dry deciduous forests. The total forest area to be utilized amounts to 727 ha with a total of approximately 1,94,828 trees would be removed from their natural habitat. The overall floristic diversity in Hubli-Ankola railway zone constitutes of 43 families, 106 genera and 134 species of trees and 58 families, 128 genera and 146 species of shrubs. Besides this, 10 species of pteridophytes belonging to 9 families and 9 genera are also present in the Ghat section.

The Western Ghats stretch from Yellapur to Sunksal is rich in floral diversity, endemism and evergreeness with a high tree density and basal area. The natural forests in this region are of evergreen to semi-evergreen types characterized by several endemic tree species such as *Myristica malabarica, Polyalthia fragrans, Cinnamomum macrocarpum, Holigarna grahami, H. arnottiana, Hopea ponga* etc. Many trees in this region also harbor a rich flora of epiphytes (orchids) including endemic species such as *Aerides crispa, Cleisostoma tenuifolium, Oberonia brunoniana, Porpax jerdoniana*, etc. The

ecological condition of this region supports a rich ground flora which involves a good number of endemic and medicinal herbs.

ENVIRONMENT MANAGEMENT PLAN - MITIGATION MEASURES:

Environmental Management Plan (EMP) proposed here aims to mitigate measures to restore and preserve the eco-system from the possible adverse impacts due to the proposed Hubli-Ankola railway project. The mitigation steps are used to minimize or prevent negative impacts on environment due to proposed development activity.

MITIGATION FOR FOREST LOSS

***Restocking the forests*:** The total forest area to be utilized for the project has been estimated to be about 727 ha. An estimated 1,94,828 trees are required to be removed from their natural habitat, as per the forest department estimate. Therefore per ha stand density (of trees) works out to just 268 trees only. Anywhere in the Western Ghats terrain, including the undulating inner coastal forests, the tree density/ha could be to the tune of 300 to 400 ha easily. For instance our forest sample study sector in the Sector-6 (Tarekunte-Mattihakkal-Birgadde region in the core of the ghat section) had 598 trees/ha (Table 1). Taking an average of 350 trees/ha as the ideal carrying capacity, there is tremendous scope for mitigating the damages to the forests by enhancing the stocking capacity of poor grade forests (33 trees/ha in Sector-10; 102 trees/ha in Sector -9; 134 trees in Sector-1and so on). This is an ideal way to compensate for the likely loss of ecosystem goods and services and carbon sequestration potential.

The good prospects for forest recovery under management: We wish to emphasise here that adoption of better management programs in the coming years, through especially local community involvement, through constitution of VFCs, and BMCs, it should be possible to raise forest biomass two to ten times in most places. There is as well great scope for enhancing forest biodiversity as well to not only compensate for the losses due to railways but to gain much more. Once again it needs to be stated that most forests en route the railway alignment and its buffer zone are much below their potential carrying capacity. If we set 35 m² as the minimum desired basal area/ha, it is appalling to note that 70% of the forests are stocked below this minimum desired level. The railways, obviously will take a toll on the forests; but in terms of tree numbers, species, and biomass it should be possible to mitigate the damages and even gain much more. For this purpose, we have suggested an elaborate list of trees, shrubs and climbers for propagation in the buffer zone of the railways and beyond. This list is specially prepared considering the sector-wise suitability of the species, their value to the wildlife, as sources of food for humans, medicines and various NTFP. With some good efforts it should be possible to create well designed model forests, rich in native plant species and providing

high quality ecosystem services, using the potential carrying capacity within the respective sectors.

Area available for compensatory afforestation: We introduce the concept of diffused planting using the understocked areas and blanks, and poor grade monoculture plantations, as far as possible within the respective Sectors, which we have identified already. We have excluded here the utilization of grassy blanks for forestry purposes, in order to safeguard the fodder resources of wildlife. These suitable areas are to be dealt with using a twin strategy of planting appropriate species as well as through protection by fencing expected to improve the stand density automatically through natural regeneration. We have identified nearly 796 ha of such suitable areas for reforestation activities in 10 of the Sectors, that we have divided the railway zone into.

We recommend **peoples' nurseries** to get ready saplings instead of centralized nurseries of forest department. This will generate more of rural employment potential, all along the proposed alignment areas, for the same people who might as well be important stakeholders in the future on the very vegetational wealth they create . It is notable that several habitually forest dwelling communities here, such as Gowlis, Siddis, Kunbis, Karivokkaligas, Halakkivokkals etc. can be associated as partners in conservation efforts and benefit sharing in accordance with the various forest regulations and provisions and Forest Dwellers' Act, 2006. Year-wise progress achieved in these afforestation activities has to be recorded. In addition we also recommend **fencing of blocks of forest lands** with basal areas of less than 15 sq. m each, for minimum periods of 8-10 years, to the tune of about another 800 ha altogether. Fencing will prevent the entry of domestic cattle and humans into these protected blocks and pave the way for natural regeneration of especially native species of plants.

MITIGATION FOR WILDLIFE IMPACTS:

Railways and highways are major causes of wildlife mortality throughout the world. Railways also cause direct loss of habitat, degradation of habitat quality, habitat fragmentation, population fragmentation/ isolation and reduce access to vital habitats.

- ***Creation of fodder reserves:*** It is very necessary to enrich the forests impoverished of wild animal fodder plants, using the land resources of poor-grade monoculture plantations, degraded forests, abandoned mine areas, underneath high tension power lines and such identified stretches.
- ***Creation/maintenance of water bodies:*** Water bodies are to be created intermittently in the forest areas so that the movement of animals in dry months could be minimized. Several old village ponds and tanks need desilting and maintenance.
- ***Bird food plants:*** The region harbours over 256 species of birds, of which 70 species were sighted during our survey. Trees and shrubs that produce various types of berries and seeds

consumed by birds are included in the list of plants recommended for afforestation of blanks and degraded areas, so as to amply make up for the losses that would be incurred by the forest ecosystems due to the railway project.

- ***Care of Hornbill nesting trees:*** Hornbills are among the keystone bird species of forest ecosystems along with Imperial Pigeons, and many other large birds such as woodpeckers. These birds use tall trees or nesting. Such trees within the railway buffer zones may be identified, marked and preserved. During the construction phase, any such trees along the proposed alignment should be spared from cutting until the nestlings emerge and fly away.
- ***Bridging the steep cuts*****:** Steep cuts alongside the railway tracts can act as death traps for elephants, as they would find it difficult to climb up on them on the sudden approach of the trains. We suggest covering such area in the vulnerable locations, the usual movement path of elephants, with concrete roofs covered with soil and raise natural vegetation on them, of grasses, herbs, climbers, shrubs and small trees natural to the area. Combination of cut and fill tunnels (overpass) and bridges (underpass) at sensitive locations would ensure the safe passage for elephants.
- ***Signals connecting camera traps:*** Camera traps are widely used in research and management of especially major mammals these days. Development of a signal system linking animal sightings in the buffer zone through camera traps to the railway control rooms may be considered seriously.
- ***Increasing visibility:*** Sharp curves have to be minimized. Rank growth of vegetation alongside tracks in the vulnerable stretches (especially weeds such as *Chromolaena* and *Lantana*), which reduce visibility and also poses fire hazard during summer months, has to be cleared. Soil mounds that block vision en-route have to be flattened. These steps are good both for better vision of the drivers as well as of the animals.
- ***Physical barriers***: Trenches may be useful in some areas like especially alongside sharp curves. Iron-concrete pole barriers will be of help in vulnerable locations.
- ***Joint patrolling:*** The forest department and the railways should constitute a joint patrolling team to track wildlife movements in the vulnerable stretches and send messages to the station masters and train drivers of the need to exercise vigilance.
- ***Speed limits***: The speed in vulnerable stretches should not exceed 25 km/hr., safer for the drivers to negotiate, on sighting wild animals. The major vulnerable stretch, from the elephant crossing point of view, being a mere 35 km wide belt, hardly would cause an hours delay, and that too during the months of elephant movements only.
- ***Reduce steepness of embankments:*** In locations where elephants are likely to cross, other than where the covered cuttings are to be constructed, in accordance with the forest department's recommendations, the steepness of embankments should be made gentler to facilitate easy escape of animals.
- ***Increasing the formation width of cuttings*****:** Often it is the narrowness of the railway-track

sides, atop the steep embankments, or alongside tracks in dugout areas, that trap wild animals, panicking them and eventually leading to their deaths or injuries. Such strips alongside tracks have to be widened, for the animals, including domestic cattle to take refuge during train movements.

ACTION PLAN FOR FORESTS TO SUPPORT LIVELIHOODS:

Forests have been conventionally seen as sources of timber and industrial materials or other commercial products. The potential of forests to sustain millions of livelihoods on a sustainable basis needs to be explored more. The livelihood security of the people in the forest villages and the adjoining areas needs to be strengthened in various ways without compromising quality of habitats (forest and wildlife rules to be followed strictly). The Non Timber Forest Produce (NTFP) traditionally played a major role in supporting livelihood of village community.

Degraded forests and catchment areas of streams and poor grade plantations may be planted with medicinal plants and NTFP species. Creation of a system of small scale nurseries to be run by marginal farmers and tribals will lead to greater employment opportunities. Programmes for sustainable harvesting of medicinal plants from the wild may be implemented. Forests need to be enriched with NTFP plants for supporting rural livelihoods. Such a move, combined with formation of Self Help Groups and JFM Committees etc. for sustainable use of NTFPs will replace the contract system, known to be detrimental to regenerative capacity of NTFP species.

Affected people for ecosystem restoration: To assuage their losses it is recommended that the eligible and those aspiring to work for compensatory afforestation programs, and future maintenance and co-management of forests be given priority.

DRAINAGE OF STREAMS

Drainage of the alignment requires paramount attention, so that the landslides and mudflows that the Konkan Railway and Mangalore-Hassan Railway experience during monsoon months can be averted. The forest department may take precautionary steps to protect stream ecology through restoration of native riparian species that check soil erosion, flooding and landslides. Notable of these riparian species which have strong network of roots include *Carallia brachiata, Ficus racemosa, Hopea ponga, Pongamia pinnata, Pandanus* spp. etc. To stabilize the loose boulders along steep streamside, a good option is to remove them, and grow *Ficus arnottiana* (‘Kallaswatha’) which cling on to these rocks by their strong roots and keep such in place.

LANDSLIDES AND MUDSLIDES:

Mitigation strategies to minimize landslides include:

- **Identification of landslide prone areas:** Based on soil and rock structure, rainfall patterns, slope and vegetation characteristics (evergreen, deciduous, scrub, plantations, fields, gardens etc.) and human impacts, preparation of landslide hazard zonation maps at 1:1000 scale are essential.
- **Drainage correction:** In the hilly areas natural drainage patterns should be studied and maintained properly without any blockage. Characteristic stream-side species are to be promoted for stream-bank protection and ecology.
- **Restoration of vegetation cover:** A replanting programme should be undertaken giving priority for strong and deep rooted species which check erosion and withstand water-logging. *Pongamia pinnata, Calophyllum inophyllum, Ficus racemosa, Thespesia populnea, Barringtonia* spp., *Terminalia arjuna* etc. may be considered for lower slopes bordering the estuarine areas. Middle and upper slopes in landslide prone areas should be planted with trees having lower biomass but stronger and deeper root networks. High biomass trees are likely to cause the weight of the overburden precipitating slope failures in future. Minimum of 350 trees/ha would be ideal number for the hills. Locality-specific members of the natural vegetation of any given area may be given priority. The general practice of monoculturing of trees has to be discontinued in all hazard zones

- **Turfing**: The Vetiver grass covering effectively and at low cost, protects slopes, stop or significantly reduce the risk of slippage, and prevent down stream water contamination. Vetiver grass roots with a high tensile strength (~ 75 MPa) increase shear strength of soil and hence reduce slope hydraulic pressures through the removal of water. The combination of slippage prevention (mass wastage of soil) and its sediment filtering ability results in very clean water moving down the catchment.

- **Enhancing the scope of VFCs:** The scope of the already existing village forest committees may be expanded to landslide/natural resource management as well. Necessary awareness and training programmes may be arranged for them in landslide prevention and management.
- **Regulations on slope cutting and quarrying:** Indiscriminate slope cuttings have to be strictly regulated and engineering solutions such as protective walls/embankments to be made where they are essential. Bio-protection is by far most important. Quarrying for stones and soils to be strictly banned in these localities which pose threat of landslides.

SOIL EROSION:

For catchment area treatment (CAT) and compensatory afforestation (CA), Karnataka Forest Department and Railways (SWR) have to consider the local ecological aspects and to do planting

with suitable native plant species. The chosen species should help in:

1. Restoration eventually of multi-strata tree community;
2. Render ecosystem services and
3. Support local livelihoods.

Providing vegetative cover, which could be of grass, creepers, etc, could minimize soil erosion and silt transportation during monsoon from poorly vegetated localities. These could arrest siltation and act as soil binding agents. Soil and moisture conservation must comprise construction of bunds and check dams as well as fencing for protection against any interference. However, vegetative means to arrest soil erosion in the catchment are more beneficial from ecosystem point of view. Vegetative covers on barren soils add to both fertility and water-conservation value as well as to prevent erosion and trapping of pollutants. Soil binding and moisture conserving properties of many grasses could be tried to arrest soil erosion. Some of them are, *e.g., Saccharum spontaneum, Panicum repens* (or Torpedo grass specially for fixing banks and bare soil), *Sorghum halepense, Brachiaria species, Urochloa mosambicensis, Dactyloctenium australe, Eragrostis lehmanniana, Paspalum dilatatum, Cynodon plectostachyus, Pennisetum clandestinum and Imperata cylindrica*. These could be tried keeping in mind the local preference and conditions.

DECENTRALISED SOURCES OF ENERGY- RENEWABLE SOURCES:

In the proposed Hubli-Ankola railway zone, it has been found that except for the monsoon season, remaining time of the year, solar energy is available in good potential and can be effectively utilized. Hence, it is suggested that solar energy enabled devices should be used for lighting lamps, railway signals, etc. which will reduce the dependency on conventional sources of energy.

MITIGATION MEASURES DURING CONSTRUCTION PHASE

Soil from the Western Ghats is a precious asset to be lost. Top soil rich in organic content, porosity, high microbial diversity, root mats and invertebrates, should be stocked in designated places and used for spreading in poorly vegetated areas, in monoculture plantations with eroded and rocky surfaces and used profitably for forest enrichment. No trading in forest top soil by contractors should be permitted. More compact inner soil along with the rubble may be used for embankments, landfills and leveling in station areas and other requirements of railways. Soil and rocks should not be dumped anywhere in the forest areas destroying vegetation. Nor should the dugout materials be allowed to block streams and drainage areas. Quality rocks should be reworked for construction materials and other railway needs. Vegetation covers (with grasses, etc.) are to be provided to minimize the silt yield in the catchment.

1. Wet drilling should be adopted to avoid dust generation. During high wind atmosphere, dust-generating activities should be stopped. The vehicles carrying the excavated earth and other dumping materials should be covered properly.

1. Movement of heavy vehicles for excavation and transportation through forest areas may impact

trees and ground vegetation as well. Precautions are to be exercised to minimize dust emission which is likely to envelop trees and leaves in particular, and arrest photosynthesis;
2. Dumping of excavated earth is to be done at the locations, pre-identified considering the topographical parameters and minimize large scale topography alterations in stream catchments;
3. Repair and maintenance of village roads as these roads are likely to get damaged due to the movement of men and materials and heavy machinery and transportation of tunnel debris.

***Blasting impact mitigation*:** Blasting in the forest areas for quarrying, tunneling, rock breaking etc. can disrupt wildlife. Mobile wildlife leave the blasting areas on disturbances. We suggest that blasting be not allowed from 6 pm to 6 am, when many wild animals are on the move, and also not to disturb the sleep of the villagers in the neighbourhoods. The blasting operations should be executed in a well-planned and properly controlled manner observing full safety code as per instructions of directorate of explosives.

MITIGATING IMPACTS DUE TO SOLID AND LIQUID WASTE AND OTHER POLLUTION

Constituting an independent 'Waste Management Cell': The Waste Management Cell (outsourced to Local NGO) has to ensure overall hygiene in the Hubli-Ankola railway zone while adopting the waste management measures.

- ***Safe disposal of waste from stations and trains***: Birds, mammals and reptiles can be injured or killed by the trash we discard into the forest areas. Even domestic cattle are also injured or killed by such wanton activities of humans. Plastic packaging materials, glass bottles, cardboard, paper etc. are discarded from the running trains by the passengers. Waste food items thrown from the trains in plastic, aluminium foil and cardboard cartons, by unwary passengers can attract several wild animals towards the track.
- **Liquid Waste:** The blackwater and greywater to be collected in retention tanks in coaches and evacuated at designated stations and along with sewage from stations should be treated in anaerobic treatment plants.
- ***Extended Producer Responsibilities (EPR)**:* Large amounts of plastic and paper wastes are generated through catering services. The railways should introduce EPR whereby the caterer take responsibility of the wastes like plastics within the railway premises. According to EPR producers can either reuse, buy-back or recycle the wastes generated and thereby limit the liability of the railways in waste management.
- ***Public sensitization*:** Informative hoardings and notices regarding waste management should be placed at appropriate places in vernacular languages. Passengers should be participative in environmental protection. The messages on safe and hygienic ways of waste disposal, refraining from littering the trains, tracks and stations etc. should be flashed in the compartments to sensitize the passengers. Offenders may be charged with payment of nominal 'cleaning fees' to begin with.
- **Waste segregation:** The compartments also should have proper containers for disposal of

waste, so that passengers do not throw it on the tracks. Organic wastes, plastics, metals, glasses, e-wastes etc should be segregated at source. Color coded waste bins made of non-corrosive materials installed at railway stations and in coaches should facilitate this process.

- ***Contract collection of plastic waste*:** The railways could provide certain stretches of the Hubli-Ankola track on contract basis with a buy-back guarantee for wastes collected.
- ***Recycling of other inorganic wastes*:** The collection of segregated inorganic wastes like papers, metals, glasses, e-wastes etc for recycling should be adopted
- ***Empowerment of local bodies in waste disposal:*** Garbage collection tenders to be floated for designated sections of track and payments to be released on satisfactory completion of work. The local village panchayats/municipalities may be empowered to undertake such works, which include not only cleaning of waste but also sorting out and packaging of waste wherever applicable for recycling.

MITIGATING IMPACTS FROM WORKFORCE COLONIES

Locating workforce colonies in the forest area will generate considerable impact on the existing environment and ecology of the area. Hence, to minimize the stress on the environment, it should be made mandatory for the contractors to locate workforce colonies away from the sensitive habitats and provide requisite facilities such as water for drinking purpose and other uses, energy (fuel woo, electricity, LPG), proper sanitation facility, community kitchens for the workforce camps, proper collection and disposal of solid waste generated in these camps, education facilities for the children, etc.

Thus labor management turns out to be a challenging task. We suggest here the following mitigation measures:

- The work forces should be settled in designated planned colonies with basic amenities such as water supply, sanitation, etc. and avoiding mushrooming of unplanned, temporary camping sites as is the case with most such big projects.

- Migrant workers' settlements be set up away from forest areas. All along the rail route, except in the ghat section, there are large open areas (>5 ha each), created by private landholders, and given on hire for storing iron ore. With the stoppage of ore export, these blanks today have fallen vacant, also turned unfit for cultivation. The contractors may hire these blanks for temporary settlement of railway workforce.
- Workforce quarters should be provided with all basic amenities, such as sanitation, water supply, energy, etc, provision for solid waste management etc.
- The contractors must see that the forests do not suffer any damages from their workforce, and keep vigilance over transport of timber, firewood or NTFP from the forests by their workers.

- Contractors be held responsible for any poaching of wildlife done by their workforce
- The government should make arrangement for adequate supply of kerosene/cooking gas and other non-biomass fuels to the workers, so that no damages of any kind are inflicted on the forests.
- Mandatory evacuation of workforce colonies on completion of the work: The workers be registered duly in the records of the contractors, verifiable by the forest department, and be taken back to their native areas by the contractors themselves, as soon as their assigned tasks are completed. This is to prevent their illegal settlements in encroached forest lands.
- Railways to designate an environment officer to interact with contractors, construction companies, laborers and railways and to see that labour management is in tune with the environmental standards to be maintained.
- The workers' children should be enrolled in the local schools and child labor has to be made a punishable offence under the existing laws of the country. Small kids of working parents should have day-care home facility.
- During the operation phase, the onus of preventing smuggling goods from forests, is primarily the responsibility of the railways. The railways should also co-operate with the forest department vigilance squads in checking the railway stations and trains for any smuggling of forest goods.

Taking into account the ecological significance of the Hubli-Ankola railway zone, some mitigation measures have been proposed which will help in making this project as a role model for many such projects. However, the pre-requisite for this is to implement these measures strictly with proper monitoring during different phases of the project development. Some of the mitigation measures suggested are as follows:

- Location specific afforestation with native species
- Control the spread of invasive alien plant species along the railway tracks
- Providing barricades at eco-sensitive regions
- Reduction of train speed in the elephant movement areas
- Proper collection and disposal of solid and liquid waste to avoid contamination and pollution
- Use of renewable sources of energy like solar energy for lightning of stations and railway signals
- Providing basic amenities for the workforce colonies
- Strict enforcement of Forest and Biodiversity laws to check illegal activities in the forest areas
- Proper disposal of excavated soil/debris to prevent any damage to forests
- Constitution of Environment Management Cell at South Western Railway
- Strengthening the local Forest Department
- **Constituting Post Project Monitoring Task Force**: It is strongly recommended that a Post project Monitoring Task Force should be constituted involving experts from different sectors apart from representative stakeholders for monitoring the activities during and post construction of this project.

Project Monitoring Task Force should monitor the project works adhering to the suggested norms- involving scientists, forest officers, VFCs/BMCs in respective villages (within their respective jurisdictional zones) – forest officers also within their jurisdictional zones; pollution control officers etc.

The Post Project Monitoring Task Force shall meet and visit the site at least once in three months to take into account the compliance of the environment management plan. The task force shall ensure co-ordination among many government agencies in the implementation ecosystem management to minimize the instances of forest encroachment and fragmentation, degradation of natural forests, theft of forest products, and large scale hunting of endangered, rare and threatened species of fauna.

Criteria for conservation importance of an area are determined on the basis of its ecological services and goods. The variations in the diversity, distribution and abundance of both flora and fauna are quite evident from the study. In this context, the emphasis should be laid on adopting higher standards in ecosystem management, which should include conservation, restoration of ecosystems as in case of the restitution of animal migration corridors and improving the quality of aquatic and terrestrial ecosystems in the region. The outcome of the study provides substantial information that can be considered as a benchmark to the current database on the existing biodiversity and ecology of the Hubli-Ankola region. The recommendations if implemented properly would certainly help in restoring and conserving the ecosystem of the basin.

Implementation of EMP: The various use and non-use values of ecosystem in the form of different goods and services have been quantified for the forests in Hubli-Ankola railway zone. The total economic value (provisioning, regulating, supporting and information services) is Rs. 4,085,882/ha/yr and for the forests in the entire railway alignment is Rs. 297,043,35,934 per year.

Alternatives suggested at micro level (Chapter 21) to reduce the impact on forests, has been found technically feasible at 76-86 km and 86-100km.

Acceptance of the suggestions (subsequent to EIA investigations) has contributed to

- **Reduction in track length by 3.85 km (reduced to 164.439 km from 168.289 km)**
- **Reductions in the Forest land requirement: 8.25 %, reduced to 667 hectares (from 727 hectares)**
- **Reductions in the number of tunnels: 4 (25 tunnels instead of 29)**
- **Reductions in the number of trees: 36833 (Trees to be removed 1,57,995 instead of 1,94,828)**

Based on this, ***we suggest that Rs 450 crores be provided to the* Karnataka forest department *(Yellapur, Karwar, Dharwad divisions proportional to the scale of EMP) to implement the suggested EMP (Environment Management Plan). Karnataka Forest Department shall keep the portion of this fund (at least 45%) as corpus fund and the interest accrued be utilised for meeting the recurring expenses – expenses of the post project monitoring task force (jointly with SWR), research related to biodiversity and ecology, constitution of the surveillance squad in each forest division (with adequate staff) and the expenses related to the salary and associated benefits of the surveillance squad (to minimise the instances of forest goods smuggling, etc.)***

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Associate Faculty, Centre for infrastructure, Sustainable Transportation and Urban Planning [CiSTUP]
Centre for Sustainable Technologies (astra), Indian Institute of Science
Internet based course - Environment Management:
http://wgbis.ces.iisc.ernet.in/energy/distance_education_courses/internet_course_2014/index.htm
CCE Course web http://cce.iisc.ernet.in, http://wgbis.ces.iisc.ernet.in/emcourse
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From: Karthik Madhavapeddi <karthik@indiaspend.org>
Sent: Friday, June 26, 2020 4:10 PM
To: Ramachandra T.V. <tvr@iisc.ac.in>
Subject: Request for a copy of your report on the Hubbali-Ankola railway line

Dear Sir

I work with IndiaSpend, a data journalism organisation based in Mumbai.

We are working on a story on the Hubbali-Ankola railway line, and would like to reference your study (cited here) in the story. Could you please share a copy of the report?

--
Regards

Karthik Madhavapeddi
Senior Editor
IndiaSpend & **FactChecker.in**